

PRIVATE AND CONFIDENTIAL



RESEARCH DEPARTMENT

VISIT TO AACHEN, 25th-29th SEPTEMBER, 1961

Report No. A-064

(1961/20)

**THE BRITISH BROADCASTING CORPORATION
ENGINEERING DIVISION**

RESEARCH DEPARTMENT

VISIT TO AACHEN, 25th-29th SEPTEMBER, 1961

Report No. A-064

(1961/29)

W.N. Sproson, M.A.

A handwritten signature in dark ink, appearing to read 'W.N. Sproson', written in a cursive style.

(W.N. Sproson)

This Report is the property of the British Broadcasting Corporation and may not be reproduced or disclosed to a third party in any form without the written permission of the Corporation.

VISIT TO AACHEN, 25th-29th SEPTEMBER, 1961

Section	Title	Page
1	INTRODUCTION	1
2	TECHNICAL SESSIONS	1
	2.1. General Papers	1
	2.2. Videotechnique	2
	2.3. Magnetic Video Signal Recording	3
	2.4. Transmitter Technique	4
	2.5. Receiver Technique	5
	2.6. Colour Television	5
3	VISIT TO EINDHOVEN	6
	APPENDIX	7

December 1961

(1961/20)

VISIT TO AACHEN, 25th-29th SEPTEMBER, 1961

1. INTRODUCTION

The main purpose of this visit to Aachen was to attend the ninth annual convention of the German Television Society (Fernseh-Technische Gesellschaft) and to present a paper on the subject of B.B.C. Research Department work in the field of lens testing. The convention devoted one day to industrial visits and, of the various choices offered, I chose to visit the Philips establishment at Eindhoven.

Forty-seven papers were scheduled for presentation and discussion at a total of seven sessions. A few of the papers were not presented because the East Germans were not allowed to attend the convention. The range of subjects covered the entire field of television and was subdivided as follows:

General	5 papers
Videotechnique	15 papers
Television Waveform Recording (magnetic)	6 papers
Transmitter Technique	5 papers
Receiver Technique	8 papers
Colour Television	8 papers

2. TECHNICAL SESSIONS

2.1. General Papers

The meetings were held in one of the lecture theatres of the Technische Hochschule at Aachen. This theatre, which would accommodate 400 people, was one of three large lecture theatres contained in the central building and was of post-war construction. It was quite a good lecture hall from the point of view of both lecturer and audience.

After the opening speech of welcome by the chairman, Dr. Möller, a brief introduction to the latest developments in television was given by Professor Dr. Richard Theile. This included some interesting comparisons of television and photography: one photograph of a television picture monitor showed a fairly noise-free picture obtained from an image orthicon with a magnesium oxide target receiving only 0.001 milli-lumen of luminous flux on its photocathode. At this particular level of lighting the photographic system gave no useful result. (The photographic system used a 16 mm cine camera with 23° DIN film: lens aperture same for both television camera and cine camera.) Other topics mentioned by Dr. Theile included a comparison of sizes of picture information on various materials for television recording, precision-offset operation of television transmitters and the use of satellites for intercontinental exchange of television programmes.

The first technical paper was given by Mr. D.C. Birkinshaw on "Some recent engineering developments in the television service of the B.B.C.". In the main, this paper described some of the more interesting technical features of the Television Centre although brief reference was also made to outside-broadcast equipment. There was considerable discussion on this paper: questions were asked about preferred film gauge, the run-up time for telecine machines, automatic remote control operation of telecine machines and the number of operators per camera channel. It was obvious that some German television engineers were very interested in B.B.C. operational practice at the Television Centre.

The second paper was on recent developments in the Eidophor projector and was given by Dr. Baumann. The quality of picture given by the latest version of the Eidophor projector represents a substantial improvement over the quality of pictures demonstrated at the I.E.E. earlier this year on the occasion of the symposium organized by the Television Society and the British Kinematograph Society. A comparison with the literature issued at the I.E.E. meeting failed to show any significant changes between the versions demonstrated at Aachen and in London although I have no hesitation in reporting a worthwhile improvement in contrast range (a figure of 100 to 1 contrast ratio was given during the discussion) and some improvement in definition. Dr. Baumann's paper had been pre-recorded and was given by means of the Eidophor projector.

Dr. Müller of The Fernmeldtechnische Zentralamt in Darmstadt reported on recent international conferences dealing with the subject of television standards both for Bands I and III and also Bands IV and V. As someone not very familiar with the details of this particular subject, I gained the impression that the only point on which agreement had been reached was the frequency of the colour sub-carrier for transmissions in Bands IV and V.

Dr. Dobesch's paper on the results of the meeting of Study Group III of the O.I.R.T. in Moscow, January 1961 was the first of several papers which could not be given as the authors were not permitted to leave East Germany.

Dr. F. Rudert of Fernseh, Darmstadt gave a very comprehensive paper on the subject of the design of German television studio equipment. This included some detailed results on the performance of image orthicons (on 625 lines) over the past five years or so. Whereas in the first models, modulation depths of the order of twenty to forty per cent were obtained at 5 Mc/s, the performance of modern tubes is such that sixty to eighty per cent modulation depth is now obtained at 5 Mc/s. His paper indicated that the temperature of image orthicon targets is now thermostatically controlled in Fernseh cameras, to an accuracy of $\pm 2^\circ \text{C}$.

This paper concluded the general section. It would not be particularly useful to give an account of each of the remaining papers so that I shall only describe items of particular interest in the remaining forty-two papers. For the record, a complete list of the papers is given in an appendix.

2.2. Videotechnique

My own paper on "The assessment of lenses for television" was followed by one from Dr. Frenzel of I.R.T., Hamburg on "New results of measurements on the index

of performance of television lenses using a sinewave test pattern". His method of measurement is similar in principle to ours although the instrumentation is different. Whereas in the B.B.C. equipment, the sinusoidal plate is used to perform a Fourier analysis of the spread function*, the sinusoid is used as a test object in Dr. Frenzel's equipment. His paper gave a number of detailed response curves for specific lenses whereas I avoided detailed results in my own paper in order to keep the subject matter of a general nature.

Two papers were presented on improvements in the performance of Vidicon tubes. The first of these (by W. Dillenberger of Fernseh) illustrated the picture quality obtainable with a $1\frac{1}{2}$ in Vidicon tube by using the Eidophor as a picture display device; the quality was certainly good although I don't think that it was as good as we obtain from $4\frac{1}{2}$ in image orthicons when they are working properly.

The Monday afternoon session finished with a paper by Dr. Sennhenn (Fernseh) on a transistorized Vidicon camera giving studio quality (presumably in contradistinction to closed-circuit channels intended for industrial use).

The third British contribution to the symposium came from Mr. G.E. Partington of Marconi's W.T. Co. Ltd. and was on the subject of a modern relay-operated vision mixer. It was of interest to note that valves and mechanical relays have not been replaced by transistors or other semi-conducting devices in the units described in this paper. The types of mixer described included those now in use at Television Centre.

Dr. Groll of Fernseh described a mixer for trick shots. This equipment made extensive use of transistors and described an inlay technique whereby 40 different geometrical patterns could be generated.

In his paper entitled "A non-keyed commercial clamping circuit with semi-conducting diodes", Dr. E. Kugler of Siemens and Halske described a stabilizing amplifier capable of attenuating by more than 20 dB a strong 50 c/s component added to a video waveform.

Various compact television systems for industry were described and demonstrated by K. Siepmann (Fernseh). These use 1 in or $\frac{1}{2}$ in Vidicon tubes, are fully transistorized and include one water-cooled version which is used for inspecting the interior of furnaces.

Dr. Brosch (I.R.T., Munich) described a method for the removal of line structure in film telerecordings; this combined optical and electronic devices and was claimed to be superior to the use of spot wobble. The system uses an anamorphic lens but I was unable to understand it fully and must await publication of the article.

2.3. Magnetic Video Signal Recording

Two papers in this section described devices which were new: these were in addition to papers on well-established systems such as Ampex. One device used a

*Hacking K., "An Optical Method of Obtaining the Frequency-Response of a Lens", Nature, Vol. 181, p. 1158, 19th April, 1958.

rotating thin disc (magnetic coating on a plastic base) which was capable of storing two pictures. This was described and demonstrated in a paper by H.G. Walter of Siemens and Halske (Karlsruhe). The disc was about 30 cm diameter and rotated at (I think) 3,000 r.p.m. Audible noise from the disc was not serious. Tone gradation, sharpness and noise in the reproduced picture seemed quite good although I was not near enough to a display monitor to make critical assessment. It was also demonstrated that the plastic discs could be interchanged quite easily. An air current is necessary when starting the rotation of the disc so that it is kept slightly away from the magnetic head and not torn to pieces. Once it has acquired speed no auxiliary air currents are necessary and the disc positions itself very accurately with respect to the recording/replay head.

The other new item was a one-head recorder developed at the Philips Laboratories (Eindhoven) by F.T.L. Backers and J.H. Wessels. This was demonstrated at Eindhoven on the following day and a description of it will be found in Section 3.

A paper on the latest developments of Ampex videotape recorders, viz. Intersync, Amtec and Colortec was given by K.R. Machein. As I believe this information has already been released in this country there is no point in duplicating the information here.

2.4. Transmitter Technique

Two new klystrons, YK1000 and YK1001, were described by W. Schmidt of Valvo, Hamburg. These operate in Bands IV and V and the frequency range of the YK1001 is 470 to 790 Mc/s. The klystron YK1000 has already been described in the literature* and operates over the range 400 to 620 Mc/s. The controversy on the relative merits of klystrons and tetrodes would appear to have subsided: the only question asked during the discussion was on the subject of differential phase for colour transmissions.

An interesting paper by Hopf and Dinsel describes a method of correcting a transmitter to overcome vestigial-sideband distortion. From the results shown, it would appear that the correcting circuit they propose almost completely eliminates this form of distortion. The application of the method to a signal which is successively received and rebroadcast three times was also shown.

H. Springer gave a paper describing techniques for circuit testing. This was largely derived from the work of Lewis and Macdiarmid of the Post Office, but I was unable to gather whether their work represented any extension of the original proposals.

K.H. Baer described the methods he had used to maintain a continuous check of the overall quality of television transmissions in the German south-west region. He showed the amplitude/frequency responses and the "grey-scale" characteristics of all the transmitters in his region. Whether domestic receivers were able to benefit from the improvement in overall quality was a question outside the scope of this particular paper.

*Schmidt, W., "Ein Hochleistung klystron für Fernsender im Frequenzbereich Band IV", Nachrichtentechnische Zeitschrift, September 1961, pp. 431-435.

2.5. Receiver Technique

K. Wohlenber (Telefunken) described the use of a tunnel diode as a mixer for a u.h.f. tuner. Under the optimum conditions, a noise factor of 10 dB was claimed.

H. Grosskopf of I.R.T., Munich described further work on reproduction of the neutral-grey scale in television. His study included the type of camera tube and the effect of ambient lighting. He illustrated his paper with demonstrations which included a new test card. His methods and results will merit further study when the paper is published.

The remaining papers in this section were largely on details of circuitry which, although of great value to those working on these particular aspects, were not of outstanding general interest. The discussion was not extensive for any of these papers.

2.6. Colour Television

J. Müller and G. Wengenroth gave an interesting paper on noise in a NTSC colour-television system. The paper included results on R.G.B. pictures as well as coded ones. The investigation appeared to be very thorough and this paper should be well worth studying when it is published. For R.G.B. signals fed directly to a colour monitor, the following values of the ratio of peak video signal to r.m.s. noise were quoted for the just perceptible threshold for "white" noise extending from 30 c/s to 5 Mc/s.

Signal/Noise in dB				
B	R	G	Trichromatic B and W	Ordinary Monochrome
36	41	43	44	47

For noise added to an NTSC coded picture signal corresponding table reads:

Signal/Noise in dB					
B	R	M	G	C	Y
44.2	44.0	43.6	42.4	42.6	42.4

Results were also quoted for ordinary pictures.

A general description of the SECAM system was given by W. Bruch (Telefunken). I suspect that most of the information was not new. Descriptions of various forms of delay line were included and results were presented showing that a quartz-polygon delay line introduces less distortion than that obtained with other forms. Colour slides were shown in which the upper half was a photograph of an R.G.B. presentation and the lower half a SECAM picture. With one exception the slides showed no perceptible difference between the two versions.

A most comprehensive paper on the influence of linear and non-linear errors on both NTSC and SECAM colour systems was given by H. Schönfelder (Fernseh). The

rate of communication of information at this lecture was excessively high so that even those who were much more fluent in the German language than myself had difficulty in appreciating the paper. Nevertheless, I think it will be a worth-while contribution to the literature when it is available in its published form.

It is unfortunate that transport arrangements did not permit me to hear the remaining four papers in this particular session. (For titles of the papers, see Appendix.)

3. VISIT TO EINDHOVEN

Several interesting demonstrations were presented by the Philips organization, the first of which was a demonstration of colour television. The picture source was either a camera or an "episcan" machine; the camera used three lead-oxide vidicon tubes working with about 300 ft candles incident illumination. The demonstration included a puppet show and also a live model. A three-tube Schmidt projector and some shadow-mask tubes, of Philips construction were used to display the picture. The pictures were shown in both the direct R.G.B. form and also after NTSC-type coding and decoding. Due to inaccurate adjustment, the colour balance of the NTSC version was inferior to that of the direct R.G.B. presentation and, in fact, most of the demonstration was given using the latter. The colour pictures from the camera were quite impressive: there were no registration errors, no trailing on moving objects was seen and the colour rendering was good. The "episcan" machine was used to scan various illustrated literature and this seems quite a useful device for producing colour signals.

The magnetic recorder with one recording head (previously described by F.Th. Backers and J.H. Wessels) was demonstrated at Eindhoven. The tape (one inch wide) is taken round a split cylinder (about ten inches in diameter) at a slight angle. The tape moves at 15 in/s and inside the cylinder a magnetic-recording head rotates at 3,000 rev/min. In this way magnetic tracks, inclined at a small angle to the axis, are produced on the tape. It is important that the position of line-synchronizing pulses of successive fields should be immediately adjacent in the recording, otherwise an interfering pattern is produced. The pictures produced by the recorder seemed to be of good quality. The following figures were claimed: Resolution - less than 3 dB down at 5 Mc/s; Peak-signal/r.m.s.-noise ratio 42 dB; Jitter $1\frac{1}{2}$ picture elements. In view of the last figure, this recorder is clearly unsuitable for colour recording in its present state of development. One difficulty with this type of magnetic record would be editing; a join between two tapes would be about thirty inches long.

Other items in the visit were of rather less interest: in the factory the manufacture of television sets was shown, starting from the printed chassis and finishing with the complete television receiver in a cabinet. The final demonstration showed a range of compact television equipment; all these used vidicon tubes. The smallest (price 3,000 DM) fitted into a modest sized suit case and appeared to have automatic gain control built in. Other versions included one with remote control of pan and tilt movements, zoom-lens remote control, focus and aperture; this system used switches to control a given movement. The picture quality produced both from an indoor studio and also from a remotely controlled camera mounted on the roof of a building and looking down on to the road was quite good.

APPENDIX

List of papers scheduled for presentation

1. General

D.C. Birkinshaw, London.	Some recent engineering developments in the television service of the B.B.C.
E. Baumann, Zurich.	New developments in the Eidophor Projection system.
J. Müller, Darmstadt.	Television standards: results of the latest international conferences.
*H. Dobesch, Berlin, Aldershof.	On some results of the meeting of Study Group III of the O.I.R.T. in Moscow, January 1961.
F. Rudert, Darmstadt.	Progress in the construction of apparatus for German television studios.

2. Videotechnique

F. Arp, Kiel.	Picture scanning as a transformation of a two-dimensional picture characteristic into a one dimensional function.
W.N. Sproson, London.	The assessment of lenses for television.
D. Frenzel, Hamburg.	New measurements on the performance of television lenses using a sinusoidal test pattern.
W. Dillenburger, Darmstadt.	The present-day limits of the performance of Vidicons.
W. Heimann, Wiesbaden.	The development of a 2 in. Vidicon.
*W. Gaedke, Berlin-Oberschöneweide.	New results obtained by the use of infra-red sensitive semi-conductors in picture tubes of the Vidicon type.
E. Sennhenn, Darmstadt.	A transistorized Vidicon camera with studio quality.
G.E. Partington, Chelmsford.	A modern relay vision mixer.
H.R. Groll, Darmstadt.	On a new mixer for trick shots (inlay).
E. Kügler, Munich.	A non-keyed commercial clamping circuit with semi-conducting diodes.

* not presented.

E. Legler, Darmstadt.	Remote synchronization of a portable television camera.
C. Reuber, Berlin.	Television techniques and electron microscopy.
R. Siepmann, Darmstadt.	A transistorized industrial television apparatus.
J. Buhler, Stuttgart.	Film recording using the negative method.
A. Brosch, Munich.	A suggestion for removing the line structure in telerecording on cinefilm.

3. Video Waveform Recording

K.R. Machein, Redwood City.	Report on the latest developments in Ampex Video-tape recorders.
K. Altmann and O. Schmidbauer, Munich.	On the influence of the magnetic-recording tape on the quality of video band recording.
J. Schürer, Munich.	A new method of editing (cutting) videotape.
C. Bodenstein, Munich.	The foil-disc (folienspeicher) : a method of recording television signals.
H.G. Walter, Karlsruhe.	Recording and replay of stationary pictures with the foil-disc.
F.Th. Backers and J.H. Wessel, Eindhoven.	Magnetic telerecording with a single-head recorder.

4. Transmitter Technique

W. Schmidt, Hamburg.	Results with Klystrons YK1000 and YK1001 in television Bands IV and V.
H. Hopf and S. Dinsel, Munich	Improvement in the quality of a vestigial side-band transmitter by introduction of the quadrature component.
R. Rasch, Darmstadt.	Echo distortion in television feeders with low attenuation passive four poles.
H. Springer, Munich.	Considerations on practical measurement and tolerances of starting transients of television apparatus.
K.H. Baer, Baden-Baden.	Quality control of the transmitters of the south-west region.

5. Receiver Technique

- H. Licht, Munich. Report on construction of communal antennas with new components.
- K. Wohlberg, Hanover. The application of Esaki or tunnel diode as a mixer in a u.h.f. channel-tuner.
- *H. Förster, Bremen. The extraction of the inter-carrier in television equipment.
- H. Grosskopf, Munich. The evaluation of various factors on the tone reproduction of television pictures.
- H. Lutz, Esslingen. Magnetic deflection systems of the maximum sensitivity.
- E. Jandt, Bremen. A new type of automatic line-hold.
- H. Grosskopf and A. Grünwald, Munich. On the relation between noise bandwidth and transients on a delayed synchronizing circuit.
- G.G. Gassmann, Esslingen. Negative resistance as a specially advantageous control-voltage amplifier.

6. Colour Television

- *P. Neidhardt, Berlin-Oberschöneweide. Experiments with electronic transformation of primary stimuli in a colour television channel.
- J. Müller and G. Wengenroth, Darmstadt. On the perceptibility of random fluctuation noise in a NTSC colour television picture.
- W. Bruch, Hanover. Experiments with the SECAM colour television system.
- H. Schönfelder, Darmstadt. The influence of system and transmission faults on a colour television transmission of the SECAM type.
- N. Mayer, Munich. New results of experiments with a FAM transmission system.
- F. Jaeschke and J. Müller, Darmstadt. Experiments with precision offset for the colour sub-carrier in a NTSC system.
- H. Paehr, Frankfurt-am-Main. Vitascan- Colour television pictures with 3 or 4 analysis colours.

*not presented.